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Supreme Court, U.S.
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In The

Supreme Court of the United States

ENGINE MANUFACTURERS ASSOCIATION
AND WESTERN STATES PETROLEUM ASSOCIATION,

Petitioners,

vs.

SOUTH COAST AIR QUALITY
MANAGEMENT DISTRICT, et al.,

Respondents.

**On Writ Of Certiorari To The
United States Court Of Appeals
For The Ninth Circuit**

BRIEF OF *AMICUS CURIAE* SUNLINE TRANSIT AGENCY IN SUPPORT OF RESPONDENTS

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INTEREST OF *AMICUS CURIAE*

SunLine Transit Agency ("SunLine") is a California joint powers authority organized and existing pursuant to California Government Code §6250 et seq. and composed of the California cities of Desert Hot Springs, Palm Springs, Cathedral City, Rancho Mirage, Palm Desert, Indian Wells, La Quinta, Indio, Coachella and the County of Riverside. SunLine is a fleet owner and operator as well as a world renowned leader in the development and application of alternative fuel technologies. SunLine advocated for the adoption of the Fleet Rules by the South Coast Air Quality Management District that are challenged in this case and files its brief in accordance with Supreme Court Rule 37.3.[1]

STATEMENT OF THE CASE

SunLine Transit Agency ("SunLine") submits this *amicus curiae* brief in support of Respondents, the South Coast Air Quality Management District ("SCAQMD" or "South Coast"), et al., and Natural Resources Defense Council, et al. (collectively referred to as "Respondent") and in defense of the district court decision which upheld the Fleet Rules adopted by SCAQMD against various preemption challenges. *Engine Mfrs. Ass'n v. SCAQMD*, 158 F. Supp. 2d 1107 (C.D. Cal. 2001) and as affirmed by the

[1] The parties have consented to the filing of this brief. This brief was not authored in any part by counsel for any party, and no persons or entities other than *Amicus Curiae* or its counsel have made a monetary contribution toward the preparation or submission of this brief.

Ninth Circuit Court of Appeals in *Engine Mfrs. Ass'n v. SCAQMD*, 309 F.3d 550 (2002). SunLine adopts the Statement of the Case submitted by Respondent with the addition of the following background considerations and urges affirmance of the decisions below.

SunLine has experience that is significant to this case. SunLine was a vocal supporter of the adoption of the Fleet Rules by South Coast and participated throughout the rule making process in expression of its position. SunLine's service area is well known as a haven for recreational activities, sporting some 200 golf courses and serving as the venue for one of the "Masters Series" tennis tournaments held at the Indian Wells Tennis Garden. The Coachella Valley in which SunLine operates is nearly surrounded by high mountain ranges whose geographic and environmental features have the potential to "re-create" the air quality problems experienced by the Los Angeles basin as the population in the area grows. Clean, healthful air is a prime attractant for the tourist industry that fuels much of the economy in SunLine's territory. Long before the adoption of the Fleet Rules at issue in this case, leaders in the Coachella Valley were concerned about preservation of the area's air quality. With the aspiration in mind to prevent degradation of its air resource, in 1993, SunLine's board of directors adopted a policy which required the agency to purchase only alternatively fueled vehicles for both revenue and non-revenue purposes. In 1994 SunLine became the first public transit agency in the United States to become 100% alternatively fueled through its purchase of compressed natural gas ("CNG") buses and related support vehicles. SunLine currently operates a total of 54 alternative fueled buses which tally a total of 4 million miles per year in fixed route operations.

Of the total 54 alternative fueled buses operated regularly by SunLine, 47 are CNG powered, 2 run on Hythane®, 2 are electric powered and 3 are operated using liquified natural gas (LNG). The 54 heavy-duty transit buses are only a portion of the full SunLine fleet. In addition to its buses, SunLine operates 25 CNG powered vans used in its paratransit service. These vans, ranging from 7 to 14 passenger size (plus wheel chair lifts & ADA equipment) drive in excess of 875,000 annual miles. Also in the fleet are 40 support and specialty vehicles ranging from passenger cars to heavy-duty trucks. These vehicles operate an additional 662,000 annual miles.

Since its initial commitment to alternative fueled vehicles and programs, SunLine has grown to become a recognized global expert in the alternative fuel movement, having been invited to make presentations in many foreign countries, including Taiwan, Canada, Germany and Chile, to name a few, concerning the operational, economic and practical aspects of CNG fleet operations. Due in large part to SunLine's innovation, what once was viewed as a new relatively untested technology in CNG fleet operations, has now proven to be a time tested, reliable and cost effective manner of operating a fleet.

SunLine is also a leader in the research and development of other clean fuel technologies for commercial application and is a pioneer in research and development related to the use of hydrogen as a fuel. Due to the inexhaustible source of clean burning hydrogen, this technology promises a likely next step in the fight against air pollution. SunLine is utilizing Hythane® fuel in two different applications designed for commercial use. Hythane® combines a mixture of 20% hydrogen with 80% CNG to further reduce emissions already achieved by

CNG alone by 43%. In the near term, Hythane® has been used by SunLine to power a more conventional modified engine in commercial transit application and achieves significant air quality benefits from reduced emissions. (See the Cummins Westport, et al., Report entitled "Upgraded B Gas Plus Engine for Operation with Hydrogen Blended Natural Gas Fuel" attached as Appendix, pp. 1 through 6).

In the long term, another new and promising technology uses Hythane® with fuel cells in a commercial application, another arena in which SunLine is a pioneer. Not only is SunLine a founding member of the World Wide Fuel Cell Transit Consortium, it also became the first transit agency to operate a hybrid fuel cell bus in transit revenue service in a project sponsored by the U.S. Department of Energy through its National Renewable Energy Laboratory, the SCAQMD and others.[2] SunLine is also in the process of acquiring one of four prototype transit buses intended to be powered by a fuel cell specially designed for this purpose. All of SunLine's efforts are devoted to the primary goal that it shares with the Clean Air Act; that of achieving and preserving the air quality in its region. SunLine's hope is that its work in the development of alternative technologies advances the use of cleaner technology by others to achieve the same purpose.

SunLine responds to the joint *amicus curiae* brief of the American Automotive Leasing Association and National

[2] A copy of the DOE Hydrogen Fuel Cell & Infrastructure Technologies Program Report on SunLine's hydrogen bus demonstration project is attached as Appendix, pp. 7 through 12.

Association of Fleet Administrators Inc., (collectively referenced here as "AALA"). AALA makes several factual claims in support of its legal argument to the effect that the Fleet Rules are pre-empted by Section 246 of the Clean Air Act which AALA characterizes as part of a federal policy that established a limited, uniform series of fleet regulations. AALA's policy arguments are founded upon fears and speculative barriers that are inconsistent with the actual operational experience of SunLine as a fleet operator and with the goals of the Clean Air Act as a whole.

AALA asserts that several unique attributes of fleets were meant to be addressed by Congress in its adoption of the clean-fuel fleet program ("CFFP") which Amicus characterizes as a uniform federal scheme for fleet regulation. According to AALA, requirements of the Fleet Rules adopted by the South Coast Air Quality Management District discourage and frustrate the environmental benefits already generated by fleet operations. (See AALA, p. 5-6). AALA contends that this is so because the industry already provides "tangible air quality benefits" due to improved fleet maintenance and the fact that vehicles are selected to be "right sized" such that they do not unnecessarily consume pollution generating fuels. (See AALA, p. 5). Operational difficulties are feared by AALA in the industry's potential exposure to varying fleet requirements among different jurisdictions in which they operate and they assert that they face increased costs associated in their compliance with the Fleet Rules and the restrictive

choices given them to choose among "right sized" compliant vehicles.[3]

AALA's arguments are unpersuasive when they are considered in the context of the entirety of the Clean Air Act, the amendments of which the CFFP is a part, and with the Fleet Rules themselves. There is no support for the proposition that Congress intended for Section 246 of the Clean Air Act to occupy the field of fleet regulation or to provide an exclusionary uniform federal scheme for the regulation of fleets. The fact that Congress adopted Section 246 in the first instance undermines AALA's premise that fleets already contribute their "fair share" of emissions benefits over and above that of the "general population" such that they should remain essentially self regulated. If such were the case, Section 246 would not have been offered by Congress as an optional method for nonattainment area States to adopt as a method to lower emissions.

AALA's claim that the CFFP was intended to provide a uniform system of regulation designed to protect fleets from varying State standards is also misplaced. If this were truly the purported Congressional purpose in adopting Section 246, it would have more plainly signaled that

[3] AALA's fears about limited choice in the available vehicles that are of an appropriate size to meet varying fleet needs are unfounded as demonstrated by the growing number and variety of alternatively fueled vehicles offered on the market. (See for instance, the wide range of CNG powered light, medium and heavy-duty vehicles in many different sizes and configurations that are manufactured by well recognized producers such as Ford, GMC, Orion and Thomas among others at the website of the California Natural Gas Vehicle Coalition, www.cngvc.org).

intent. The fact that Congress has adopted fleet requirements in other areas which differ from the CFFP stands in contrast to AALA's uniformity argument. Although certain features that address the practical aspects of fleet operation were logically included in the development of the language of Section 246, such considerations should not be read out of context or be extended to the level of an overriding Congressional mandate that undercuts the balance of the Clean Air Act and the dual regulatory system that forms its framework. Rather, the CFFP should be construed as consistent with the broader goals of the Clean Air Act to protect the public health from increasing risks associated with air pollution in nonattainment areas.

One of the inherent difficulties in the administration of the Clean Air Act ("CAA") is the basic fact that the occurrence and levels of air pollution are not "uniform" or restricted to certain State or local boundaries, a fact recognized as the starting point for Congress having established its dual federal/state regulatory system which affords the States and their political subdivisions wide latitude to regulate aspects of air quality under Sections 101 (42 U.S.C. §7401) and 116 (42 U.S.C. §7416). Congress did not choose to include the provisions of Section 246, or others of the CFFP in its list of federally regulated subjects where it has chosen to pre-empt the field and to provide for a single uniform regulation of the subject matter. In light of these considerations, AALA's arguments for field and conflict pre-emption of the Fleet Rules by Section 246 should be rejected.

I. IN THE EXPERIENCE OF SUNLINE, OPERATION OF LOW EMISSION AND ALTERNATIVELY FUELED FLEETS IS NOT MORE BURDENSOME THAN OPERATION OF TRADITIONALLY FUELED FLEETS.

In addition to its more recent research activities, SunLine, along with the Sacramento Regional Transit District (another CNG fleet operator), participated in a study entitled "Three Year Comparison of Natural Gas and Diesel Transit Buses" ("Three Year Study").[4] The Three Year Study found that CNG alternative fuel vehicles provide far better savings in terms of maintenance than their dirtier diesel counterparts. SunLine achieved a 27 percent reduction in maintenance costs compared to a diesel fleet and Sacramento Regional Transit achieved a 38 percent savings. (The comparison figures are to older diesel buses in the Sacramento fleet, a factor recognized by the study and accounted for in its findings.) The Three Year Study also documented the savings in terms of fuel cost achieved by both transit agencies in their use of clean burning compressed natural gas. Not documented, was the cost savings in terms of human health benefits that both transit agencies produced in their reduction of harmful air emissions in the regions in which they each operate.[5]

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[4] The Three Year Study is attached as Appendix, pp. 13 through 36.

[5] The Three Year Study was based upon actual operations by two diverse transit agencies utilizing the technology in service under differing conditions in contrast to the assertion by Amici Curiae, Alliance of Automobile Manufacturers, et al., to the effect that one transit official *anticipated* that future operations of advanced diesel

(Continued on following page)

AALA has pointed to the contribution of its members to the air pollution problems faced by many jurisdictions in that its members arguably use "right sized" vehicles to meet the varying demands of their operations, implying that the choice of vehicles covered by the Fleet Rules is limited. Any such claim is not factually supportable. There is no lack of variety in available models of low-emitting or alternatively fueled vehicles. In the transit bus arena alone, more than 19 available models from major industry suppliers are listed in the California Natural Gas Vehicle website (www.cngv.org). In addition to public transit service with alternative fuel buses, SunLine also serves other municipal functions for its member cities which includes street sweeping operations that rely solely upon alternative fueled vehicles. All of the street sweeping vehicles, water trucks, pick up trucks, dump trucks and support vehicles were readily available on the open market for SunLine's purchase and use. Another governmental duty SunLine provides is that of regulating taxicabs for the valley cities, and SunLine recently assisted the taxi and limousine industry to purchase 50 alternative fuel vehicles that range from passenger sedans to passenger vans that are used in the transport of the public to and from local airports and other destinations. As demonstrated by the California Natural Gas Vehicle Coalition web site listings, a wide variety of alternative fueled vehicles in differing sizes and specifications are therefore presently available with more choices slated for the future.

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vehicles would be the "most cost effective way to reduce emissions." (See brief of Alliance of Automobile Manufacturers, et al., p. 22, fn. 28).

II. THE COURT SHOULD REJECT AMICI'S ARGUMENT THAT SECTION 246 OF THE ACT PRE-EMPTS THE FLEET RULES.

The amicus brief of AALA asserts that the federal clean-fuel fleet program ("CFFP") set forth in Section 246 of the Clean Air Act (42 U.S.C. §7586) pre-empts the Fleet Rules. AALA argues that Congress has pre-empted the field of fleet regulation by adopting the CFFP even though Section 246 is not included in the list of pre-empted subjects. Since it is not so included, AALA must fashion its argument upon implications of pre-emption which invite an "extravagant mode of interpretation" rejected on more than one occasion by this court (see for example *Northwest Central Pipeline Corp. v. State Corporation Commission of Kansas*, 489 U.S. 493 (1989).

The Clean Air Act is well recognized as one of the most comprehensive pieces of legislation adopted by Congress which is designed to achieve and maintain air quality standards by, among other things, imposing standards for air quality to be achieved by the States and their political subdivisions. Congress did not, on the one hand impose mandates without also preserving to the States the regulatory tools needed to realize the public health and safety goals inherent in the Clean Air Act. The proposition that Congress intended to preserve the authority of the States to regulate fleets is reflected first and foremost, by the fact that Section 246 is not included in the Section 116 list of Clean Air Act provisions intended to be pre-empted. *See* 42 U.S.C. §7416 (listing exceptions to the "savings clause" of the Clean Air Act). This omission is crucial and should be the paramount consideration in evaluating the viability of the Fleet Rules, in the context of the dual regulatory structure of the Clean Air Act. This is a case where caution

should be used to "avoid encroachment" into the areas that Congress intended to be reserved to the States. *Northwest Central Pipeline Corp. v. State Corporation Commission of Kansas*, 489 U.S. 493 (1989).

Nor is the presumptive hurdle created by the omission of Section 246 from Section 116 overcome by AALA's implied pre-emption argument primarily because a State may elect to opt-out of the clean fleet provisions of Section 246 either in whole or in part. In addition, both Congress and EPA have either adopted differing fleet requirements in other regulatory contexts or have recognized that the States and their subdivisions may do so. The fleet regulations of the CFFP cannot be said then, to be "so pervasive" or to "touch upon a field" of federally intended dominance sufficient to support an implied pre-emption argument. *Fidelity Fed. Sav. & Loan Ass'n v. De La Cuesta*, 458 U.S. 141 (1982)

Finally, SCAQMD's Fleet Rules do not conflict with any federal policy under the Clean Air Act designed to establish uniformity in the regulation of fleets that operate in multiple jurisdictions. Even if such a purpose were to be artificially grafted into the CFFP, specific exemptions included in the Fleet Rules operate to alleviate any burdensome compliance requirements.

A. Section 246 Is an Optional Program for Improving Air Quality in Nonattainment Areas.

The CFFP and Section 246 originated in the 1990 Amendments to the Clean Air Act and concern improvements to air quality in designated nonattainment areas. *See* Pub. L. No. 101-549, 104 Stat. 2399 §299 (1990)

(codified at 42 U.S.C. §7586). The emissions reductions required pursuant to Section 246 and the CFFP apply only to States with ozone or carbon monoxide nonattainment areas. Under the 1990 Amendments, each State that contains a covered nonattainment area must submit to EPA a revision of its state implementation plan ("SIP") adopting either the federal CFFP or a substitute program, approved by EPA, that produces an equivalent or greater reduction of pollution. *See* 42 U.S.C. §7511a(c)(4). The CFFP, which is a program requiring fleet operators to include specified percentages of clean-fuel vehicles in their fleets by given target dates (*see* 42 U.S.C. §7586(a)), is an optional ready-made federal model that States may use as one of many tools to achieve air quality improvements in the nonattainment areas. In sum, States can adopt the CFFP or find another way to achieve the same reductions. The CFFP does not dictate to the States a rigid set of rules for imposing clean-fuel vehicle purchase requirements on fleet operators, but rather, supplies a model program for achieving air quality improvements. The 1990 Amendments reflect that Congress continued to allow States the same traditional flexibility that formed the initial basis for the CAA in achieving the emissions reductions.

B. The CFFP Does Not "Occupy the Field" of Clean-Fuel Vehicle Purchase Requirements.

AALA's argument, that the CFFP occupies the field of fleet purchase regulation, faces a significant hurdle in establishing evidence of clear Congressional intent to pre-empt state regulation in this area. In order to support an inference of field pre-emption, the scheme of federal regulation must "touch a field in which the federal interest is so dominant that the federal system will be assumed to

preclude enforcement of state laws on the same subject" and must be "'so pervasive as to make reasonable the inference that Congress left no room for the States to supplement it.'" *Fidelity Fed. Sav. & Loan Ass'n v. De La Cuesta*, 458 U.S. 141, 153 (1982) (quoting *Rice v. Santa Fe Elevator Corp.*, 331 U.S. 218, 230 (1947)). The full context of the Clean Air Act of which the CFFP is only a part, does not justify such an inference of pre-emptive intent.

If traditionally the federal government has not been active in the relevant regulatory field, Congress must be especially clear in its intent to pre-empt the subject matter. "Where the field that Congress is said to have pre-empted has been traditionally occupied by the States, 'we start with the assumption that the historic police powers of the States were not to be superseded by the Federal Act unless that was the clear and manifest purpose of Congress.'" *Hillsborough County, Florida v. Automated Medical Laboratories, Inc.*, 471 U.S. 707, 722, 723 (1985) (quoting *Rice v. Santa Fe Elevator Corp.*, 331 U.S. 218, 230 (1947)). The lower federal courts have found air pollution control to be a regulatory area traditionally dominated by the States and thus have required evidence of clear Congressional intent to pre-empt such State efforts. *See Exxon Mobil Corp. v. U.S. EPA*, 217 F.3d 1246, 1255 (9th Cir. 2000) (Air pollution prevention falls under the broad police powers of the States, which include the power to protect the health of citizens in the State); *Envt'l Encapsulating Corp. v. New York*, 855 F.2d 48, 53-54 (2d Cir. 1988) (finding that the State asbestos program at issue "unmistakably involves an exercise of a State's police powers").

This principle has particular effect where, as in the case of the CAA, Congress has developed a long standing

dual regulatory role between itself and the States – including the political subdivisions of the States such as Respondent. (See *Northwest Central Pipeline Corp. v. State Corporation Commission of Kansas*, 489 U.S. 493 (1989), and *Wisconsin Public Intervenor v. Mortier*, 501 U.S. 597 (1991)). Congressional intent, as derived primarily from the face of the language and structure of the statute itself, is the starting point for review. "In analyzing whether Kansas entered a pre-empted field, we must take seriously the lines Congress drew in establishing a dual regulatory system, and we conclude that paragraph (p) is a regulation of 'production or gathering' within Kansas' power under the NGA." *Northwest Central Pipeline Corp. v. State Corporation Commission of Kansas*, 489 U.S. 493, 513 (1989). The lines of demarcation drawn by Congress for purposes of pre-emption are expressly drawn in the CAA in several places.

First, under Section 116 (42 U.S.C. §7416) of the CAA Congress has specifically listed those provisions that it intends to have pre-emptive effect in its dual regulatory system under Section 101 (42 U.S.C. §7401).[6] The fact that Congress omitted Section 246 from its well recognized list of pre-emptive provisions provides strong evidence that it had no intent to afford such an effect to the CFFP. Secondly, Section 246 must be read in the context of the findings and purpose of the Clean Air Act as a whole, and

[6] The listed pre-emptive Sections only include (in addition to designated Sections of the Act effective before 1977), Section 209 (pre-emption of state standards relating to the control of emissions from new motor vehicles or new motor vehicle engines), Section 211(c)(4) (regulation of fuels and fuel additives), and Section 233 (standards respecting emissions from aircraft or aircraft engines).

should not be evaluated in isolation as is the case with AALA's argument. On the one hand, EPA has established certain national ambient air quality standards ("NAAQS) to be met by the States as directed by Congress in Section 108 (42 U.S.C. §7408). The power required for States to meet the NAAQS is expressly reserved to them under Section 116 (42 U.S.C. §7416) and is a critically required feature for their achievement of the public health goals sought to be advanced by the Clean Air Act. AALA's argument invites the same sort of "extravagant interpretation" rejected in *Northwest Central Pipeline Corp. v. State Corporation Commission of Kansas*, 489 U.S. 493 (1989) where the State was specifically reserved authority over certain aspects of gas production but, it was argued, could not enforce its regulations. It has long since been resolved under the CAA that the dual regulatory system of that statute not only permits, but dictates that States and their political subdivisions develop measures designed to achieve the air quality standards imposed by the statute. *Train v. Natural Resources Defense Council, Inc.*, 421 U.S. 60 (1975) "So long as the ultimate effect of a State's choice of emission limitations is in compliance with the national standards for ambient air, the State is at liberty to adopt whatever mix of emission limitations it deems best suited to its particular situation" subject only to the limitations expressed on the face of the statute itself. *Id.* at p. 746. Similarly, here, "it would be strange indeed" to hold that Congress imposed a mandate upon the States to achieve ambient air quality standards established by the EPA yet deprived them of the means in which to comply with the statutory directive.

Nor is the fact that the Fleet Rules were adopted by South Coast rather than by the California Air Resources

Board or the California Legislature of any importance to a pre-emption analysis. The California Air Resources Board is not the only political subdivision within the State of California empowered to regulate air quality. The SCAQMD is specifically authorized by California Health and Safety Code Section 40447.5 to adopt fleet rules thereby reflecting, at the State legislative level, a choice that Respondent's contribution to "the mix" of regulations to clean the air could specifically include the adoption of rules regulating fleets.

In the case of power under the Clean Air Act, the authority of the States and their political subdivision is expressed in Section 101 (42 U.S.C. §7401) which delineates Congressional findings to the effect "(a)(3) that air pollution prevention (that is, the reduction or elimination, through any measures of the amount of pollutants produced or created at the source) and air *pollution control at its primary source is the primary responsibility of States and local governments*" (Emphasis added). In terms of its declaration of purposes, Section 101 includes "Pollution prevention" as a primary purpose and recites as its goal "to encourage or otherwise promote reasonable Federal, State and local governmental actions, consistent with the provisions of this Act, for pollution prevention." (see 42 U.S.C. §7401(c)). These Congressional statements of intent expressly acknowledge the important role played by States and their political subdivisions in achieving the goals of the statute.

The structure of the 1990 Amendments enacting Section 246 and the CFFP also indicate that Congress did not intend to occupy the field of fleet purchase regulations. The concern of Congress in enacting the CFFP was with achieving emissions reductions, not with regulating fleets.

The lone decisive factor governing EPA's approval of a Section 246 substitute program is whether or not the program is designed to achieve emissions reductions equivalent or superior to those contemplated by the CFFP. EPA must approve a SIP revision implementing a State substitute program if the program "will achieve long-term reductions in ozone-producing and toxic air emissions equal to those achieved under [the Act's clean-fuel vehicle program], or the percentage thereof attributable to the portion of the clean-fuel vehicle program for which the revision is to substitute." 42 U.S.C. §7511a(c)(4)(B). This language is unambiguous in its restriction of EPA's discretion to a consideration of a single variable: emissions reduction. *See* 42 U.S.C. §7511a(c)(4)(B) (EPA "*shall* approve . . . any revision" that produces equivalent reductions) (Emphasis added). So long as the substitute program promises equivalent emissions reductions, its other features are essentially irrelevant, including whether the program incorporates any particular provision of the CFFP. This feature provides further support that Congress did not deviate from or "supplement" its goals to pursue uniform fleet regulation as a purpose under the CAA when it adopted Section 246.

For evidence of Congressional intent to limit the discretion of the States to regulate fleets, AALA also points to provisions in Section 246 such as the requirement that the program be "vehicle- and fuel-neutral." (*See* AALA, et al., at p. 14). Since States may "opt-out" of the CFFP by implementing a substitute program that lacks vehicle- and fuel-neutral provisions altogether, particular provisions of the CFFP cannot be read to reflect a Congressional intent to limit the wide latitude otherwise granted the States and their political subdivisions to regulate in the field. EPA's

approval of California's LEV program as a substitute for the CFFP illustrates the broad leeway States have in opting out of the CFFP. *See* 64 Fed. Reg. 46,849 (1999) (California submitted and EPA approved, California's Low Emission Vehicle ("LEV") Program as a replacement for the CFFP). The LEV Program is California's regulatory program setting standards and certification requirements for new light- and medium-duty motor vehicles pursuant to Section 209(b), 42 U.S.C. §7543(b), of the Clean Air Act. The LEV Program consists primarily of tailpipe emission standards and production requirements for light-duty and medium-duty motor vehicles. No aspect of the LEV program regulates or concerns fleets or fleet purchase requirements. In approving the substitution of the LEV Program for the CFFP, EPA, in conformance with the directive of Congress, recognized that the substitution would commit California to achieve "long-term reductions in ozone and toxic air contaminants . . . provided by the [CFFP]." 64 Fed. Reg. 46,849 (1999).

The fact that all provisions in Section 246 may be disposed of by States, if they design a different program to achieve Section 246 reductions, undercuts AALA's assertion that "fuel-neutral" and other provisions of Section 246 are intended to occupy the field. The "character of obligation imposed" by the CFFP – i.e., a reduction in ozone and toxic air contaminants – does not suggest that Congress wanted fleets regulated in a particular, federally-stipulated fashion. *Rice v. Santa Fe Elevator Corp.*, 331 U.S. 218, 230 (1947). The CFFP would not be a "pervasive" regulatory scheme that would occupy the field even if it were mandatory, and it certainly does not occupy the field where compliance with the scheme is wholly optional.

C. The Fleet Rules Are Not Inconsistent With And Thereby Pre-empted by Section 246 Under "Conflict Pre-emption" Principles.

AALA also argues that the Fleet Rules are inconsistent with Section 246 and therefore pre-empted by principles of conflict pre-emption. Conflict pre-emption may exist where "'under the circumstances of the particular case'" the state or local requirement "'stands as an obstacle to the accomplishment and execution of the full purposes and objectives of Congress.'" (*Geier v. American Honda Motor Company, Inc.*, 529 U.S. 861, 873 (2000) citing *Hines v. Davidowitz*, 312 U.S. 52, 67 (1941)

Where, as here, there is a dual regulatory role established in the statute, any conflict pre-emption analysis "must be applied sensitively . . . so as to prevent the diminution of the role Congress reserved to the States, while at the same time preserving the federal role." *Northwest Central Pipeline Corp. v. State Corporation Commission of Kansas*, 489 U.S. 493, 531 (1989). The fact that some impact or effect upon an area within the federally established side of the equation is created by the local regulation does not "trigger" a finding of a conflict because inevitably, "jurisdictional tensions" are inherent in any dual regulatory system. *Id.* at p. 515.

The conflict pre-emption argument of AALA fails for the reasons outlined above: nothing in the text, structure, or legislative history of the Clean Air Act demonstrates a Congressional intent to establish uniform fleet purchase requirements, and the States' ability to supplant the federal CFFP with their own programs fatally undermines such a view of Section 246. The only uniformity sought by Congress in enacting the CFFP was to compel States with designated nonattainment areas to take further affirmative

action to achieve emissions reductions – either through the CFFP or by otherwise intensifying their regulatory efforts to achieve emissions reductions.

1. There is no support for AALA's argument that there is a federal policy of uniformity with respect to fleet purchase requirements.

In support of its assertion that there is a federal policy of uniformity with respect to fleet purchase requirements, AALA cites EPA's notice of proposed rule making ("NPRM") for the CFFP. (*See* AALA at p. 4, 14, and 28 (citing 58 Fed. Reg. 32,474 (1993)). Contrary to this assertion, the NPRM makes no mention of a congressional purpose and provides no evidence of a federal policy of uniformity. *See* 58 Fed. Reg. 32,474 (1993) (The NPRM's only discussion of uniformity is its summary of comments received from AALA et. al.'s constituents: "The industry strongly requested that a patchwork set of state programs be avoided. The industry stated that this would assist their implementation, reduce their costs, and improve overall program effectiveness. . . . As a result, the members of the fleet industry requested regulations to ensure that states would enact similar programs.")[7]

The fact that Congress and EPA have adopted, or recognized, non-uniform fleet regulations in these other

[7] Moreover, the rules adopted by EPA apply only to States that choose to adopt the federal CFFP, not to those that go their own way. Whatever uniformity is promised by EPA's rules, then, can be undercut by States' adopting nonconforming substitute programs.

contexts speaks volumes. For example, the Energy Policy Act ("EPACT"), imposes fleet requirements that are not "fuel neutral" and differs from the "fuel neutral" provisions of the CFFP, upon which AALA relies to support its argument. EPACT requires federal and state fleets to use vehicles operating on "alternative fuels" which include natural gas, methanol, ethanol, electricity, and other fuels that are "substantially not petroleum."[8] *See* 42 U.S.C. §13211(2). Thus, Congressional enactments affecting fleet operators are themselves not uniform in their requirements.

In other contexts, EPA has recognized that existing state and local clean fuel fleet programs differ from the CFFP and has never indicated any intent to pre-empt such programs. *See e.g.,* 56 Fed. Reg. 50196, 50198 (1991) (Preamble, Clean Fuel Fleet Credit Programs) ("In addition to the clean fuel fleet program required by the Clean Air Act, there are a number of other programs being implemented or considered at national, state or local levels, which involve the introduction of clean fuel vehicles in fleets. There is expected to be some overlap between the requirements for vehicles in these programs and those for vehicles in the CAA fleet program.") EPA has not referenced any intent by Congress or by the agency to establish a set of national, overriding standards to regulate fleets. EPA's statements in the preamble to the Clean Fuel Fleet

[8] While EPACT alternative fuel requirements apply to light and some medium-duty fleets, not heavy-duty fleets, 42 U.S.C. §13211(9), the law nevertheless demonstrates a Congressional purpose to support the development and deployment of alternative fuel vehicles and non-uniformity with respect to designation of fuel types in programs regulating fleets.

Credit Programs is "dispositive on the question of an implicit intent to pre-empt" unless it clearly conflicts with Congressional intent. *Hillsborough County, Florida v. Automated Medical Laboratories, Inc.*, 471 U.S. 707, 714 (1985). AALA has failed to make a showing of "implicit pre-emption of the whole field, or of a conflict between a particular local provision and the federal scheme that is strong enough to overcome the presumption that state and local regulation of health and safety matters can constitutionally coexist with federal regulation." *Id.* at p. 723. A finding that the CFFP occupies the field of fleet regulation would contradict EPA's statements in the Clean Fuel Fleet Credit program and invalidate portions of EPACT.

2. The Fleet Rules do not interfere with any purported objective of a policy of uniformity, even if such a federal policy or Congressional intent could be implied from the CFFP.

AALA argues that the Fleet Rules are pre-empted by Section 246 because they stand as an "obstacle" to the Congressional purpose of the CFFP which is to regulate fleets in a uniform manner. (See AALA pp. 28-29). AALA cites *Geier v. American Honda Motor Company, Inc.*, 529 U.S. 861, 873 (2000) in support of its position. The analysis of the statutory structure under the *Geier* case is distinguishable for several reasons. First, *Geier* considered the continued viability of a state tort claim premised upon a specific standard that was the concurrent subject of an *express* pre-emption provision of the National Traffic and Motor Vehicle Safety Act. The CFFP was not similarly elevated by Congress to be included in either Section 209 or Section 116 of the CAA.

The opinion in *Geier* also made clear that the conflict pre-emption analysis is fact specific and does not exist unless "under the circumstances of the particular case" the state or local law is an "obstacle" to the purposes and objectives of Congress. *See Geier*, supra, 529 U.S. at 873. On the facts of this case, the Fleet Rules simply do not interfere with any purported objective of requiring uniformity in order to protect fleet operators operating in multiple states. The Fleet Rules are designed to address operators' concerns regarding operation outside the boundaries of the District and contain exemptions that apply to fleets which include vehicles operating in more than one jurisdiction or geographic area.[9] Each of the District's Fleet Rules contains a provision allowing exemptions where a compliant vehicle is not available or suitable for use. (Rule 1191(f)(8), Rule 1192(e)(2), Rule 1193(e)(3), Rule 1194(e)(2), Rule 1186.1(e)(1)(C), and Rule 1196(e)(1)(C)).

AALA's argument is founded on a faulty premise that the purpose and objective of Congress in adopting the

[9] Rule 1192, pertaining to transit bus fleets, contains an exemption for buses used for long-distance, out-of-District trips. Rule 1192(e)(1)(B). Rule 1194, pertaining to commercial airport ground access vehicles, such as shuttles and taxis, likewise exempts vehicles providing long-distance, out-of-District service. Rule 1194(e)(1). Similarly, Rule 1196 contains an exemption for heavy-duty vehicles used routinely to transport materials in and out of the District. Rule 1196(f)(6). Rule 1196, which applies to public agency heavy-duty fleets not covered by the more specific rules and to fleets whose jurisdictions extend beyond the boundaries of the District, contains an additional exemption for vehicles garaged or used within the District for less than 180 days in a year. Rule 1196(f). There is no need for such an exemption for light-duty passenger vehicles, or for medium-duty vehicles, since the majority of models of these vehicles available in California comply with the fleet rules running on gasoline.

CFFP was to promote uniformity in the regulation of fleets when, in fact, the Congressional purpose was to promote the attainment of clean air. In *Geier,* this court found, after reference to extensive administrative proceedings, that the statutory purpose was to provide manufacturers with a "mix" of options to implement federally mandated passive restraint systems in motor vehicles. By contrast, under the CAA, the discretion allowed by the statute rests not with the fleet industry, but rather with the States to develop the "mix" of regulations they require to achieve the federally mandated air quality standards imposed upon them. The CFFP is one of a myriad of available options within the limits of the State's authority under Section 209. Finally, unlike the court's discussion in *Geier,* the Clean Air Act's legislative history offers nothing to compensate for the lack of evidence of pre-emptive intent in the statutory text or structure. Nothing in the legislative history of the 1990 Amendments (enacting Section 246), including the committee reports or floor debates, even implicitly suggests that Congress intended the CFFP was intended to displace all state action in the area.

Finally, in *Geier,* a majority of this court expressly rejected the dissent's position that a "special burden" was placed upon the party claiming pre-emption where there was either a savings clause and a pre-emption provision (or both) and that ordinary conflict pre-emption provisions were to apply. *Id.* at pp. 870, 871. SunLine believes that the legislative structure of the Clean Air Act distinguishes it from the statute at issue in the *Geier* case and urges the court to consider some form of analysis (by whatever name) that creates a strong presumption against a finding of implied field or conflict pre-emption within the context of a dual regulatory structure, particularly where it is

coupled with a mandate such as that of Section 110 (42 U.S.C. §7410(a)(1)). Unlike the provisions of the National Traffic and Motor Vehicle Safety Act at issue in *Geier*, the Clean Air Act is first and foremost a mandate to the States, directing that they achieve certain levels of air quality in a timely fashion. When this statutory mandate is coupled with the savings clause of Section 116 (42 U.S.C. §7416), the explicit pre-emption provision of Section 209 (42 U.S.C. §7543), and the findings and purposes set forth in Section 101 (42 U.S.C §7401), some additional burden or presumption against implied pre-emption would be logically justified.

In the circumstances of this particular case, AALA cannot carry its burden of proving that the Fleet Rules interfere with the purposes of any Congressional intent for regulation of fleets uniformity, even if such intent could be implied from the CFFP program.

CONCLUSION

If States and local governments are to make progress in the field of air pollution control as mandated by Congress under the Clean Air Act, their tools for achieving its purposes must be preserved. Judicial restraint and caution has directed the past course of review where arguments for implied field and conflict pre-emption have been advanced. This is particularly true where the statute at issue structures a dual regulatory role between the federal government and the states. No indicia of Congressional intent to pre-empt State authority can be tied to Section 246. For the foregoing reasons, SunLine supports the South Coast Air Quality Management District in its

defense of the district court's opinion and urge this court to affirm that decision.

Respectfully submitted,

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Cummins Westport SunLine Westport INNOVATIONS INC.

Upgraded B Gas Plus Engine for Operation with Hydrogen Blended Natural Gas Fuel
•Overview and Summary Results•

▸ ***Introduction***

With funding from the U.S. Department of Energy through NREL and SCAQMD, SunLine Transit Agency initiated a project to demonstrate two buses operating on a mixture of natural gas and hydrogen (HCNG or Hythane®). SunLine asked Cummins Westport Inc. (CWI) to upgrade the CWI B Gas Plus engine rated at 230 horsepower. The work was done by Westport Innovations Inc., a parent company of CWI. Hydrogen Components Inc. of Littleton, Colorado, which led the previous Hythane® engine tests, is an advisory member of the current project team.

Previous investigations have shown that the presence of hydrogen in the natural gas enabled leaner (air/fuel) mixtures to be used, leading to reduced nitrogen oxides (NOx) emissions.

▸ ***Objectives***

The objectives of the engine upgrade portion of the project were to:

- determine if significant NOx reductions could still be achieved on modern engines operating closer to the lean (air/fuel) limit;
- determine the most suitable hydrogen content in the range of 15% to 30% by volume for the B Gas Plus engine, with the constraint of retaining the engine performance and efficiency;

- configure engine controls for operation on the chosen mixture; and
- calculate the overall emissions benefits.

Engine

The HCNG upgrade was developed for the CWI B Gas Plus – an in-line 6 cylinder, electronically controlled and turbocharged lean burn spark-ignited engine. The engine has a displacement of 5.9 liters and is certified at NOx+non-methane hydrocarbons (nmHC) levels of 1.8 g/bhp-hr and particulate matter (PM) of 0.01 g/bhp-hr when fitted with the standard oxidation catalyst.

Hardware modifications were limited to the fuel flow rate sensor. All other components remained unchanged.

Method

Natural gas and hydrogen blends were prepared and stored in a high-pressure storage vessel.

The fuel mixture was fed to a B Gas Plus engine that was mounted on a dynamometer. The engine was operated under steady-state conditions at four selected speeds and loads. At these operating points, engine combustion was optimized over a defined matrix for hydrogen fractions between 20 and 32%.

A 20% hydrogen content by volume was found to provide the most cost effective benefits when taking into consideration the engine and vehicle performance attributes. Range consideration was also taken into account – for example, a 20% hydrogen mixture reduces the range of a vehicle by approximately 15%, unless more storage vessels or higher-pressure vessels are used. A 20% hydrogen

mixture contains 3% hydrogen by mass and 7% hydrogen by energy.

A full engine map was developed for the chosen mixture, and was verified over the steady-state AVL 8 mode cycle, which approximates the heavy-duty transient certification cycle.

Selected Results

Figure 1 shows that the power and torque curves are maintained over the full engine speed range under HCNG operation.

Figure 1

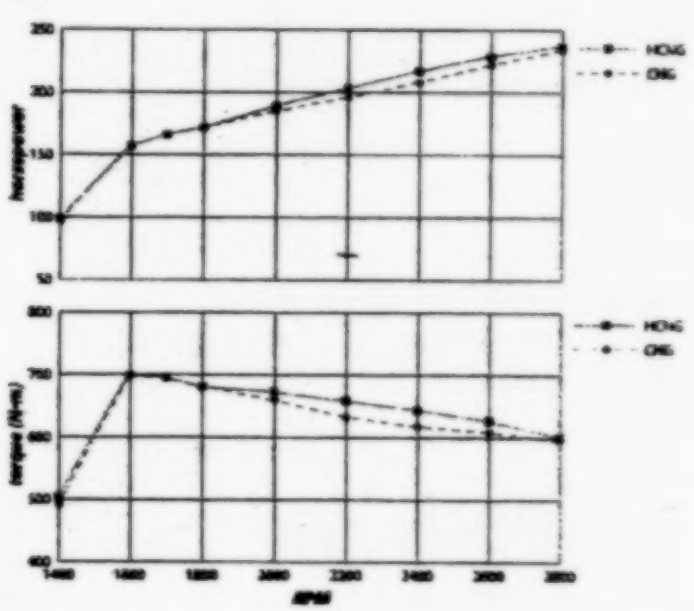
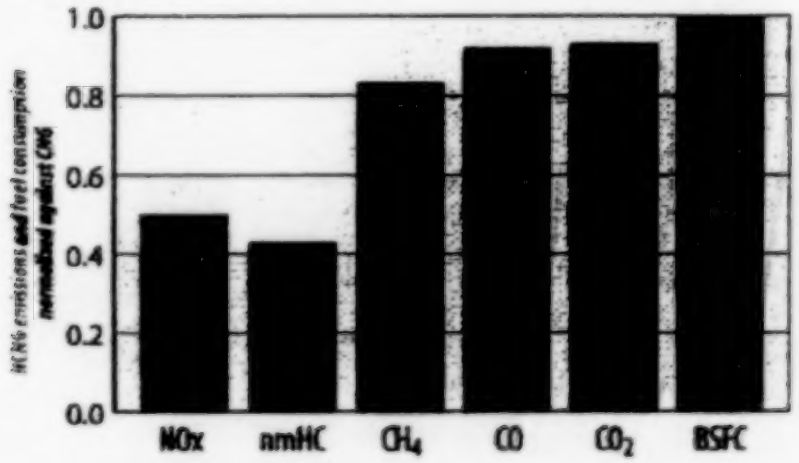


Figure 2 shows the pre-catalyst emissions results normalized compared to the original natural gas operation. It shows that NOx and nmHC emissions are reduced by 50%, while CO and CH_4 emissions are slightly reduced. As expected, CO_2 emissions are reduced by 7%, consistent

with the hydrogen energy content, and with the maintained fuel consumption also shown in Figure 2.

Figure 2



The engine transient response was found to equal that of the original natural gas engine operation over a simulated transient school bus cycle. The school bus cycle simulates transient changes in engine speed and load on an engine dynamometer representing driving of an actual heavy-duty vehicle involving idle operation, gear shifts, cruise and rated power operation.

HCNG Benefits

An upgrade of Cummins Westport's engines to HCNG would allow hydrogen to become a more rapid part of the transportation fuel mix by enabling its usage in modern, electronically controlled engines. Within a short time, commercial Cummins Westport engines could be powering medium- and heavy-duty vehicles using hydrogen. This would catalyze the development of the hydrogen infrastructure needed for future vehicles powered by pure hydrogen.

Based on the results achieved in this project, it appears that substantial NOx reduction could be achieved compared to both regular natural gas operation and diesel operation. Opportunities may also exist for improved efficiency and lowered greenhouse gas (GHG) emissions.

Next Steps

As part of the Sunline demonstration, the two HCNG buses will complete a 24,000 mile (38,624 km) on-road test starting in the summer of 2003, which will include chassis dynamometer testing of the vehicles. Two control CNG buses will also be monitored for comparison.

Opportunities exist to apply HCNG to other engines as well. An upgrade to the C Gas Plus engine rated at 280hp could be developed for large buses and trucks.

To develop a fully commercial engine, CWI will have to perform further product development tasks. For example, formal emissions certifications or verification tests should be conducted. Also, while previous demonstrations indicate that natural gas fuel system components are not affected by the presence of 3% hydrogen by mass, formal components durability testing must be completed.

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FUEL CELL BUS DEMONSTRATION PROJECTS

Hydrogen Fuel Cell & Infrastructure Technologies Program

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Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

SunLine Test Drives Hydrogen Bus

IN FALL 2002, SUNLINE TRANSIT AGENCY became the first transit agency to put a hybrid fuel cell bus into routine passenger service. From November 2002 to February 2003, the prototype advanced technology bus served Palm Springs, California, which is not far from SunLine's hometown of Thousand Palms.

SunLine collaborated with the U.S. Department of Energy's (DOE) Hydrogen, Fuel Cells & Infrastructure Technologies (HFC&IT) Program on the evaluation of the 30-foot hybrid fuel cell bus that was developed by ThunderPower LLC, a joint venture by Thor Industries and ISE Research. The data gathered during the ThunderPower bus demonstration will help fleets make informed purchasing decisions and help researchers assess whether fuel cell vehicles can meet commercialization requirements.

This evaluation is one of several DOE projects that support the research and development of highly efficient, low- or zero-emission fuel cell power systems, which serve as an alternative to internal combustion engines. The demonstration is consistent with the HFC&IT goal of having advanced technology vehicles enter the marketplace by 2010.

THE PRINCIPLE BEHIND FUEL CELLS was discovered in 1839 but wasn't used in practical applications until the 1960s when fuel cells were selected to produce electricity for rockets during the Gemini and Apollo space programs. Fuel cells are favorable in transportation applications because they produce little noise, have no moving parts, and can increase a vehicle's operating efficiency by 20% to 30%.

The ThunderPower fuel cell bus has a compact but powerful 60-kilowatt fuel cell power plant to provide the required power. The propulsion system is efficient, quiet, and reliable and can triple the fuel economy of a conventional bus. Plus, the only emissions the system produces are water and air, making the bus a zero emissions vehicle.

The hydrogen fuel cell system in the ThunderPower bus works like this:

- A heavy-duty fuel cell uses hydrogen, which can be made from renewable sources (such as wind or solar power), and air to produce enough electricity to power the bus.
- The fuel cell produces electricity through a chemical process using hydrogen and oxygen from the air.
- The electricity is routed to electric motors that turn the wheels.
- On-board battery packs store energy to propel the bus and absorb energy during braking. This is known as "regenerative braking."

THE THUNDERPOWER BUS looks like a standard bus but is able to cover 11 miles on an energy equivalent gallon of hydrogen, nearly triple the fuel economy of a

30-foot conventional bus. It accommodates up to 26 riders and has a range of 175 to 200 city miles.

ISE Research (ISE-TVI) integrated the electric propulsion with the drive system power plant in collaboration with UTC Fuel Cells, which installed its newest technology proton-exchange membrane (PEM) fuel cell in the bus. The PEM combines a thin plastic film and a substance – called electrolyte – that increases the conduction of electricity.

Manufactured by Thor/ElDorado National, the bus chassis uses a drive system by ISE-TVI ThunderVolt™ and includes hybrid propulsion components of Siemens' ELFA™ propulsion system. A motive drive hybrid subsystem is based on a dual motor and controller set from Siemens. This includes a combining gearbox that directly couples to the two motors and provides a flange for a drive shaft to the differential.

The dual motor/controller set has a continuous power rating of 170 kilowatts and a peak power rating of 288 kilowatts. ISE-TVI also developed a communication system integrating the fuel cell, drive system, energy storage system, operator controls, accessory drives, and standard bus controls.

SunLine's Partners

In addition to DOE, SunLine benefits from the support of several partners. They include:

- **Demonstration partners:**
  Sacramento Municipal Utility District, the U.S. Department of Transportation, and South Coast Air Quality Management District

- **Technology partners:**
  ISE Research Corp. (system integration), UTC (fuel cell), Siemens (propulsion system), Thor/ElDorado National (bus chassis)
- **Evaluation partner:**
  National Renewable Energy Laboratory

ACCORDING TO RESEARCHERS, the commercial use of fuel cell buses may be 10 years away, but SunLine is off to a good start and is a recognized leader in selecting and using alternative fuels.

THUNDERPOWER BUS FACTS	
Bus Chassis	Precommercial ElDorado National EZ Rider 2
Model Year	2002
Length/Width/Height	30 ft./102 in./137.5 in.
GVWR/Curb Weight	34,000 lbs./25,180 lbs.
Seats	26 (with no wheel chair spaces) 20 (with two wheel chair spaces)
Wheel Base	160 in.
Service	Transit service (Line 50)
Drive System	High voltage electrical system
Engine	Two electric motors; inverters; combining gearbox; pre-commercial, zero emission fuel cell
Batteries	48 Panasonic
Transmission	Automatic
Vehicle Controls	Multiplexing system controlling all operations (driver controls, air, hydraulic, cooling system, energy management)

Brakes	Regenerative with air support
Hydrogen Storage	On-board, pressurized tanks
Propulsion	UTC fuel cell (60 kW continuous), electric AC induction motors
Drive System	Siemens ELFA™ electric propulsion
Nominal Output	2 x 85 kW @ 600 VDC
Peak Output	2 x 140 kW
Rated Speed	9,000 rpm
Storage Device	Battery (under floor in rear)
Battery Pack	600V, 48 12 V batteries
Emissions Equipment	Zero emissions
Fuel	Hydrogen fuel cells

In 1994, SunLine became the first U.S. public transit agency to abandon its diesel buses and switch overnight to an entire fleet of clean-burning compressed natural gas buses. Before the prototype fuel cell bus arrived at SunLine in 2002, the agency began generating hydrogen on site from solar power and reformed natural gas.

When the demonstration of the prototype fuel cell bus ended at SunLine, the transit agency began looking at options to acquire additional fuel cell buses. SunLine managers believe DOE's evaluation will be useful in establishing parameters, conducting environmental testing in extreme heat conditions, and transferring technology to the agency. SunLine looks forward to continuing its role as a test site for new fuel cells and systems.

The ThunderPower bus left SunLine for Chula Vista Transit to complete further testing and operation. Chula Vista is located just south of San Diego and is near ISE Research's home offices.

For More Information

Read about SunLine's experience with the ThunderPower bus in "ThunderPower Fuel Cell Bus Evaluation at Sun Transit Agency," a more detailed report that will be available in September 2003 on Alternative Fuels Data Center Web site (www.afdc.doe.gov). The publication will feature details on the buses' performance during its six months of operation at SunLine, including its three months of revenue service.

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TRANSIT AGENCY

Three Year Comparison of Natural Gas and Diesel Transit Buses

Revised August 1999

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EXECUTIVE SUMMARY

This report details the experiences of two California public transit agencies which replaced aging diesel buses with new compressed natural gas (CNG) buses in 1994. The operating characteristics and costs of 170 natural gas buses were compared with 73 older diesel buses. The natural gas bus fleets have operated well and led to cost reductions in both fleets.

The findings are particularly significant because both Sacramento Regional Transit District (RT) and SunLine Transit Agency have been using the same engine-chassis configuration, thus enabling a valid method to combine cost data for a large sample fleet of buses. The data indicates that labor for diesel equipment was almost twice that for CNG vehicles, parts were 25% more and fuel costs were nearly double.

In 1997, CNG buses saved RT over $1 million in fuel, maintenance, parts and hazardous waste disposal, a 38% per mile reduction over the cost of their diesel buses. This was an approximate cost savings that year of $0.197 per mile over 5.7 million miles with 136 buses. That same year, SunLine's CNG buses saved over $200,000, a 27% per mile reduction from the cost of RT's diesel buses. SunLine saved approximately $0.142 per mile over 1.5 million miles with 34 buses.

The incremental capital costs of CNG buses run between $35,000 and $50,000 more per unit. After three years and a combined 22.2 million miles of experience, the payback appears to be realized in approximately six to eight years or 250,000 to 350,000 miles per bus. Lower maintenance costs are attributable to thorough mechanic training and some CNG life-cycle cost reduction because of reduced engine wear.

With the absence of carbon deposits, the CNG engines at both agencies show no signs of needing a mid-life rebuild as usually done with diesel engines at approximately 250,000 miles. The Federal Transit Administration's standard 12-year replacement cycle could potentially be extended with maintenance practices concurrently improving chassis life expectancy.

Even though new CNG buses were compared to older diesel buses, the data show that the margin of cost reductions continues to grow over diesel. The rate at which diesel expenses climbed from 1995 to 1997 was 16%, while RT's CNG expenses went up 11% over the same period. This is particularly significant given that RT reduced their diesel fleet by 36% and increased the new CNG fleet by 30% during that time.

Particulate matter and other harmful emissions from CNG buses are greatly reduced over their diesel counterparts. Both Sacramento RT and SunLine have found a win-win in CNG as it is a more economical fuel over diesel and their respective communities enjoy the good citizenship of transit promoting cleaner air.

INTRODUCTION AND BACKGROUND

At the beginning of their respective transitions to alternative fuel, Sacramento RT and SunLine were operating fleets of diesel buses that were reaching significant age and needing replacement. Both public agencies began independent research into the plausible alternatives and each decided upon CNG as the best choice at the given time. It became mere coincidence that they chose the same transit bus manufacturer, chassis and engine configuration, albeit determined in great part by the availability of California Air Resources Board-certified (CARB) engine choices.

While there are known air quality advantages of CNG fuel, what has been missing is a protracted study comparing the maintenance cost impacts of CNG to diesel. Reports at the onset of the alternative fuels movement featured small sample sizes and/or a relative short study of operating period. The data in this study was collected from a large sample of buses from two transit agencies. CNG versus diesel is compared head-to-head in equal service environments and maintenance practices.

RT first began service in 1973 in the growing Sacramento, California region. RT currently operates in a 418 square mile area serving a population of 1,060,000 with 60 bus

routes and light rail. The transit fleet consists of approximately 209 buses and 36 light rail vehicles. RT serves an area that the Environmental Protection Agency has classified as severe non-attainment for air quality and is committed to eventually replacing all diesel buses with buses fueled by lower emission CNG. Ridership on buses and light rail totals approximately 24,802,000 unlinked trips per year. Overall annual operating expense is approximately $55,000,000 for all agency-operations.

SunLine first began service in 1977 in the Palm Springs and desert resort region of the Coachella Valley in Southern California. The current population is more than 260,000 and the service area is approximately 406 square miles. Once having the dubious distinction of operating one of the oldest fleets in the country, in 1994 SunLine replaced its entire fleet with CNG buses. Ridership exceeds 3,500,000 per year. The overall annual operating budget is approximately $11,000,000.

Both CNG fleets surpass the 1994 CARB stringent emission standards, primarily in reduction of particulate matter and NOx emissions. Both agencies operate fueling stations on-site. Both systems have had steadily increasing ridership over the last few years.

PROFILE OF FLEETS

In fixed route service, RT operated 136, 40-foot Orion V CNG buses built since 1993. These 136 buses operated approximately 5.7 million miles per year, each averaging about 42,000 miles per year. The 73 bus diesel fleet operated approximately 50 percent less.

SunLine operates a 100% CNG fleet of 34, 40-foot Orion V buses built in 1993 and 5, 29-foot El Dorado buses. For the purposes of this report, only the 34 Orion buses have been compared with RT's buses. Each vehicle averaged about 43,500 miles per year, together nearly 1.5 million miles in annual fixed route service. The study fleet composition is listed in Table 1.

TABLE 1. STUDY FLEET COMPOSITION

Fleet	Quantity		Year	Manufacturer	
	Diesel	CNG		Chassis	Engine
RT	48		1990	Gillig	Detroit Diesel 6V92TA
	25		1985	Gillig	Detroit Diesel V92TB
		41	1996	Orion	Cummins L10G/280
		20	1994	Orion	Cummins L10G/240
		75	1993	Orion	Cummins L10G/240
SunLine		34	1993	Orion	Cummins L10G/240
TOTAL	**73**	**170**			

Both agencies operate fully accessible fleets and complementary paratransit services, according to the Americans with Disabilities Act. The common CNG fleet configurations studied in this report are model years 1993/94/96 Orion V powered by 6 cylinder cummins L10G engines, original equipment manufactured for dedicated CNG operation. All buses at both agencies have bike racks to allow for multi-modal travel, wheelchair lifts, and air conditioning, due to extreme summer air temperatures in both regions. The diesel buses are model years 1985/90

Gillig powered by Detroit Diesel 6V92 series engines. These 2-stroke diesel engines are the most common source of bus power in the American public transit system.

METHODOLOGY

This report was prepared by researching the maintenance records and databases of both agencies. RT and SunLine use different computer-based programs to track cost categories and have different philosophies on tracking the work order process as applied to cost allocations. Those differences were manually adjusted in the final analysis and cost breakdown, such that the data could be collated into matching categorical descriptions. It appears that this process was successful as indicated by the final totals for CNG-to-CNG cost performance between the two agencies.

Assumption 1: New buses versus old. It is difficult to quantify the maintenance advantage of a completely new bus in comparison to one that has been aged in service. Certainly, a new diesel bus would show maintenance cost advantages over an old diesel bus, and the new CNG buses are being compared to old diesel. For an agency attempting to discontinue diesel purchases, the CNG cost data can still be used to make comparisons to similar vintage diesel.

All of the buses show increasing annual expense as each of the fleets age. But, the margin of cost reductions of CNG buses over diesel continues to grow, as explained in the *Years to Year Costs* section (page 6).

Assumption 2: Characterization of operating environments. RT and SunLine have very similar transit duty demands on maintainability and reliability. Ambient temperature, weather and primarily flat terrain of service

area are similar. This factor is considered negligible as an effect in collating the cost data.

Assumption 3: Weight disadvantages of CNG buses. The weight of a CNG bus can be 2500 pounds more than a diesel bus because of the CNG storage cylinders. Yet this did not present a clear problem to either agency and operational cost savings were still substantial. Tire wear was included in the parts category. The intuitive conclusion for increased brake wear due to the resulting increased inertial forces was actually found to have decreased by using state-of-the-art transmissions employing a speed retarder for additional deceleration assistance. This same property would apply to new diesel buses, too.

Assumption 4: Fuel range impacts. The potential need for interim, enroute fueling was not a problem for either agency; each has its own fueling facilities on site. There was no attribution to maintenance for a roadcall to provide refueling (or "rescue") service because planning strategies have eliminated those type of roadcalls.

Of note, the fuel range on the Orion buses is specified to be at least 350 miles for equity to a diesel bus. Range can be less due to high ambient temperatures combined with CNG heat of compression and air conditioning use. Various management strategies are employed when routes are longer than the range. Rather than using maintenance servicing trucks, a coach operator may drive out to the relief point in a fully-fueled bus and have the relieved operator return to base in the bus lower on fuel. Another scenario may have coach operators exchange buses mid-route when one is traveling back to base. These options would then be reflected in operating cost rather than maintenance cost. Management planning is crucial within

the dispatch strategy to think through the mileage and bus range of each line. Dispatchers acknowledge that it is an easy process and soon becomes standard procedure.

Assumption 5: Training the maintenance personnel. Training cost is not a factor of this report because of its many variances, as well as a shared philosophy that training is part of "business as usual" and would apply to any fuel-bus configuration. Further discussion of training is in the section *Additional Investment in Switch to CNG (page 9)*.

Assumption 6: Special projects. During the study period SunLine was very active in assisting the clean fuels industry advance the development of technology by becoming a "beta" test site for commercialization via field demonstration. The labor involved in tracking those specific projects, as well as any impact to parts, has been deducted in the final analysis to remove the potential to skew results.

Assumption 7: Extrapolation of capital cost recovery. The only portion of capital investment considered is the incremental cost of bus price over a similar diesel bus. In calculating capital recovery periods, the cost of mid-life rebuild has been omitted. At this point in their maintenance history, mid-life CNG engine rebuilds will not need to occur as with diesel buses, since engine wear is substantially reduced.

DESCRIPTION OF COST CATEGORIES

As was shown in *Public Transportation alternative Fuels . . . A Perspective for Small Transportation Operations* (Booz-Allen & Hamilton, Inc., 1992) use of "gaseous fuels

will potentially allow less maintenance and greater engine durability than operation with liquid fuels. This is because of the elimination of formation of deposits on the fuel injector tip, ring grooves, piston bowl and other combustion chamber surfaces. Oil change frequency is longer because of the reduction of formation of acidic products of combustion. Gaseous fuels will not dilute the lubricating oil, accelerating ring, cylinder and bearing wear" (pages 2-62).

Data from both agencies demonstrates this general assessment, as can be seen in the comparison of CNG and diesel maintenance costs (Table 2 and Figure 1). SunLine did not have diesel costs after 1994, since no diesel buses remained in the fleet after that time. RT continued to operate both diesel and CNG vehicles, so both comparative costs are available. Following is a discussion of 1997 statistics in Table 2.

TABLE 2.

FY 1997 CNG VS. DIESEL COST PER MILE

Cost Category	CNG		RT
	RT	SunLine	Diesel
Labor	.087	.111	.160
Parts	.088	.061	.110
Fuel	.122	.178	.223
Oil	.006	.012	.007
Indirect	.019	.015	.019
Total	**$0.322**	**$0.377**	**$0.519**

Maintenance Labor. Labor costs were computed for mechanics with chargeable time against a specific bus. Graffiti removal is included by SunLine in the labor and parts categories (body/glass). No administrative time is computed in this costs.

Maintenance Parts. Maintenance parts were consistent for both agencies, although coding for computer input varied somewhat. All parts chargeable to a specific bus were included. In general, categories included: heating/ventilation/air conditioning, body/glass, headsign, wheelchair lift, farebox, brakes, suspension, tires, driveline, cranking/charging, electrical, engine/transmission cooling, preventive maintenance, accident, and vandalism.

TABLE 3.

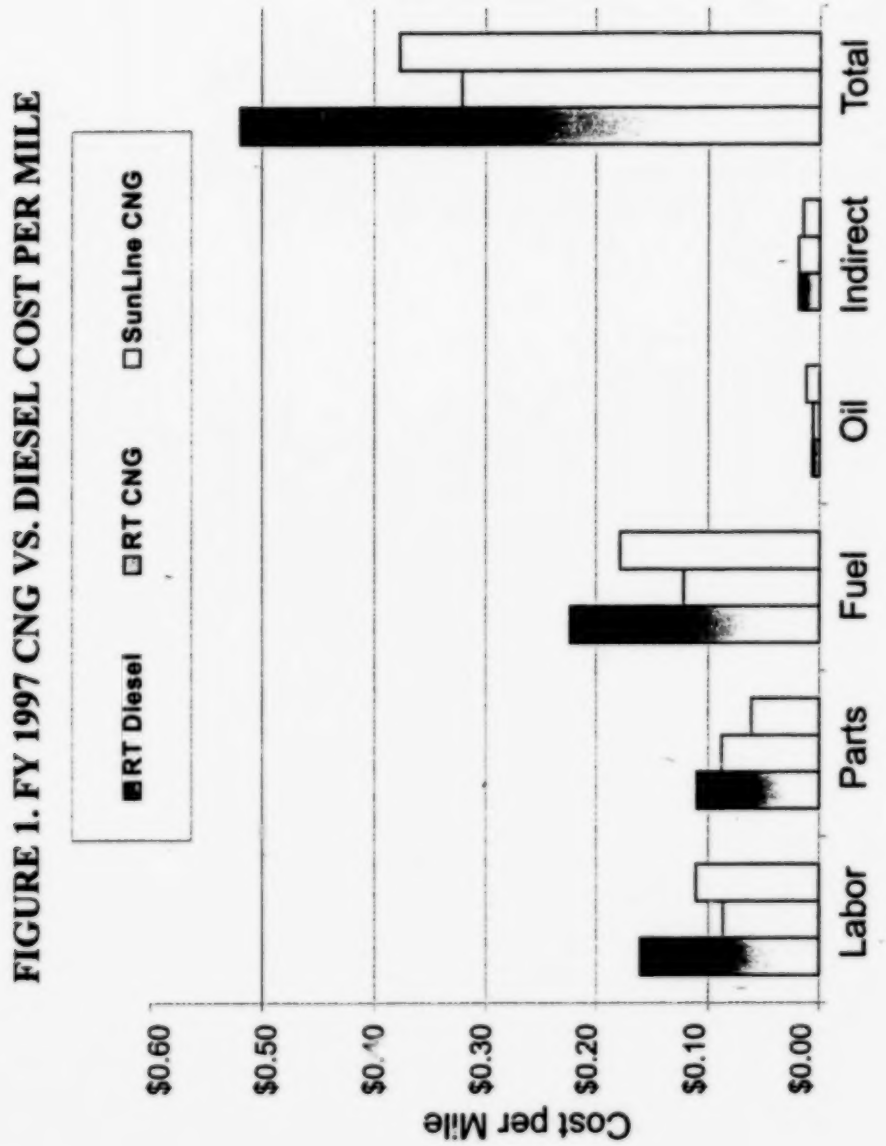
FUEL PRICES (PER GALLON EQUIVALENT)

	CNG		RT
	RT	SunLine	Diesel
1995	$0.283	$0.538	$0.692
1996	.380	.600	.735
1997	.402	.551	.599

Fuel. The cost of compression (capital, electricity, and maintenance) was not included in the figures of Table 2. RT owns 100% of its fueling facility. SunLine owns 25% of one facility and 90% of another facility. These percentages are used in fuel cost calculations. On Table 3 is a listing of fuel prices for CNG and diesel over the years of the study. While RT's diesel buses averaged 3.51 miles per gallon, their most recent mileage for CNG buses was 3.07 and SunLine's was 3.09 miles per equivalent gallon.

Oil. This category includes only the cost of oil, while other associated preventive maintenance costs (such as the filters and labor), are allocated against parts and labor, respectively. Both agencies have monitored oil quality through independent analysis and are able to extend oil change intervals between 10,000 to 12,000 miles.

Indirect Costs. Indirect costs include "bench stock," overhead, and minor parts such as bulbs, fuses and hoses which are generally low cost and not charged to specific buses. Over several years, these costs can vary dramatically depending on bulk purchases, fleet diversity and specific fleet issues. Although these costs were a minor portion of the overall cost, sometimes varying accounting procedures can affect this type of line item.



MAINTENANCE COST SAVINGS ANALYSIS

FY 1997 Category Costs. RT labor and fuel for the older diesel buses were nearly twice that for CNG buses and parts were 25% more. Indirect costs and oil remained approximately the same during the reporting period, since RT had not yet decreased the frequency of oil changes for the CNG buses. Oil change frequency has since gone from 8,000 miles to 10,000 miles.

For FY97, the data shows that CNG buses saved RT $1,122,900 in fuel, maintenance labor, and parts. This is significant with cost savings of $0.197 per mile over 5.7 million miles using 136 buses.

That same year, SunLine saved approximately $213,000, or $0.142 per mile over 1.5 million miles with 34 CNG buses. Similar to RT, cost savings are seen in fuel, maintenance, and parts. Oil changes for SunLine did occur every 6,000 miles while the buses were under warranty, and now oil changes are performed every 12,000 miles and carefully monitored by analysis.

The total cost per mile differences between the two transit agencies can be attributed to various factors. SunLine has an aggressive preventive maintenance program (PM), and therefore PM costs (labor and materials) account for 23% of the budget, whereas at RT it comprises 16%. This particularly rigorous program is also due in large part to the desert climate of the SunLine service territory, where blowing sand is a daily occurrence and vehicles must be cleaned thoroughly. SunLine also uses each vehicle approximately 3% more than RT in revenue service.

Indirect costs were slightly higher for RT than for SunLine due to the diversity of its fleet, requiring more overhead in bench stock/small parts.

Year-to-Year Costs. Cost savings can be attributed, in part, to the newness of the CNG buses. Any new bus might cost less to maintain than an older model, especially during the manufacturer's warranty period.

As expected in the data of Table 4, all of the buses showed increasing annual expense as the fleets aged. It is interesting to note that although there were expected cost savings in the first years on CNG due to the warranty coverages, the margin of cost reductions continues to grow over diesel. Figure 2 represents the rate at which costs grew by comparing the slope of trending costs. Diesel expenses climbed 16% from 1995 to 1997, while CNG expenses went up 11% over the same period for RT. That is even more significant when considering RT reduced its diesel fleet by 36%, increased the *new* CNG fleet by 30% over the same time frame, *and* the diesel buses incurred about 50% less miles each year than the CNG buses.

SunLine had higher expenses in FY95 relative to the next two years that could be attributed to two significant situations. First there was a pressure relief device (PRD) failure[1] in December 1994 that required removal and

[1] SunLine had a high pressure PRD failure inside the maintenance garage leading to a burn of vented fuel, causing no harm to personnel or damage to buses, but minor facility damage. The extreme cost impact was to hazardous material clean-up caused by fire suppression sprinkler flow into, and subsequent overflow of, waste oil reservoirs creating a massive oil spill on the property. For more details, see the article

(Continued on following page)

replacement of PRDs for the total fleet. That event would have contributed a cost of vented fuel loss to depressurize the storage system and increased mechanic time to accomplish the upgrade to newer PRDs (RT upgraded in FY97). Second, in January 1995 SunLine opened a second operating division that required the additional expense of mobile fueling of the fleet until the installation of a fixed-site compressor station.

The significant conclusion depicted here is that the reduced rate of CNG cost growth may indeed be an indicator of lower life cycle costs as addressed in the cost category descriptions and the increasing cost savings shown in Table 5.

TABLE 4. YEAR-TO-YEAR COMPARISON TOTAL COST

		Dollars per 1000 Miles		
Fuel Type	**Agency**	**FY 1995**	**FY 1996**	**FY 1997**
Diesel	RT	447	466	519
CNG	RT	290	294	322
	SunLine	366	343	377

TABLE 5. YEAR-TO-YEAR COMPARISON COST SAVINGS

Dollars per 1000 Miles			
Agency	**FY 1995**	**FY 1996**	**FY 1997**
RT	157	172	197
SunLine	81	123	142

published in *Natural Gas Fuels Magazine*, November 1995, *Safety First: Lessons Learned from a Pressure Relief Device Failure*.

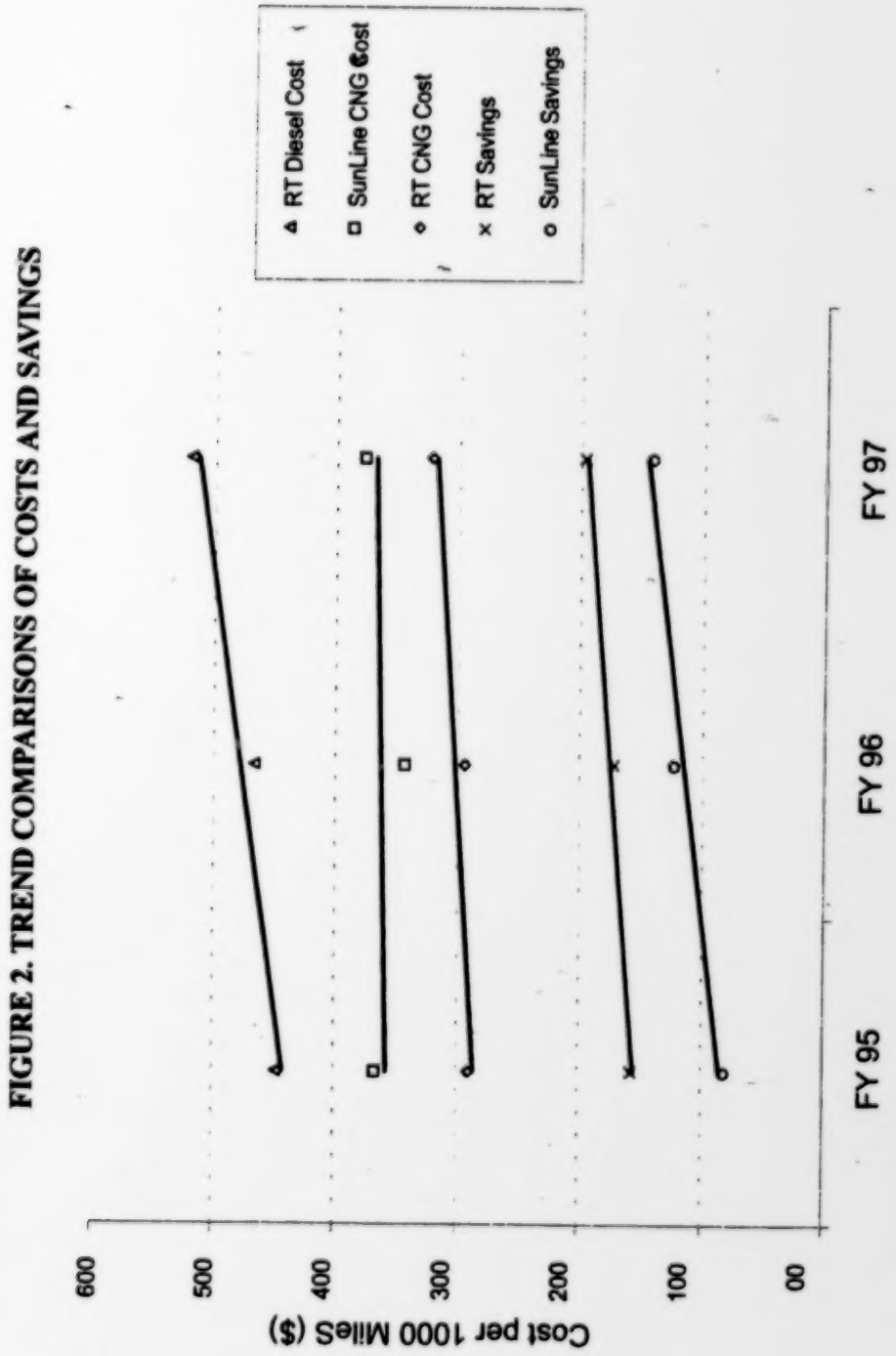


FIGURE 2. TREND COMPARISONS OF COSTS AND SAVINGS

ADDITIONAL SAVINGS

Both RT and SunLine are experiencing cost savings in hazardous waste disposal. This can be explained because of fewer oil changes. Since the 4-stroke, spark-ignited engine remains cleaner in the absence of heavy particulate matter, it does not require steam cleaning as often, which in California creates hazardous waste that must be carried away for disposal. In addition, clean-up in the shop and in the parking area is also substantially less. SunLine's hazardous waste disposal costs have decreased approximately 72% since removal of diesel buses from the fleet. RT's hazardous waste costs have decreased by one third, but are expected to decrease further as fewer diesel buses make up the fleet.

Roadcalls have not been compared because of the diversity of reporting procedures between the two agencies. For example, the Federal Transit Administration (FTA) does not specify that a malfunctioning air conditioner is a roadcall, but both agencies count these as roadcalls because of climatic conditions. Still, neither agency has experienced a significant number of CNG-system related road calls.

The transit industry diesel average is approximately 4,000 miles between road calls for all categories. Even with variances in reporting between the two agencies, the differences are impressive. SunLine's most recent figures exceeded 29,000 miles between road calls. RT's most recent figures show the CNG bus average exceeded 8,500 miles compared to 6,200 miles between road calls for their older diesel buses. SunLine's advantage can be attributed to an innovative practice of a joint inspection by the operator and mechanic when the bus returns from service

each day. This reduces the potential of unreported problems producing road calls.

INCREMENTAL COST PAYBACK

Until the manufacturing volume of CNG buses begins to match that of their diesel counterparts, the incremental cost of a CNG-equipped bus will be higher (currently between $35,000 and $50,000 more per unit). At the rate of savings experienced during the first three years of operation, the payback of the incremental cost would occur about half way through the life of the buses. Table 6 shows the payback calculated at $50,000 incremental cost per unit without consideration of life cycle cost factors.

All information currently gathered indicates CNG will have a favorable reduction in life cycle costs. RT sought to find out whether their fleet would need the mid-life engine rebuild normally required for diesel engines at 250,000 miles. Cummins West, Inc., analyzed internal wear factors to assess engine durability during disassembly of an RT engine which had 296,628 miles. The engine was found to be in very good condition and no problems were discovered which would have prevented it from continuing to operate in the fleet. The internal report noted that the bearings could easily go for double the mileage, the crankshaft was reusable without rework, the pistons were visually in "new" condition, and the oil pump was in excellent condition.

With the absence of carbon deposits, additional life-cycle cost savings have resulted as the CNG engines at both agencies show no signs of needing a $3,000 to $4,000 mid-life rebuild.

TABLE 6. PAYBACK OF INCREMENTAL COSTS

	Number of Buses	Incremental Cost per Bus	Savings per Year	Payback* in Years	Miles per Bus
			per Mile		
RT	136	$ 50,000	$1,122,900	$ 0.197	6.1	253,807
SunLine	34	$ 50,000	$ 213,000	$ 0.142	8.0	352,113

* FTA guideline for the planned replacement life of a bus is 12 years or 500,000 miles.

ADDITIONAL INVESTMENT INSWITCH TO CNG

Both agencies experienced initial costs of fuel station installation, facility modifications and training for both mechanics and operators. Other than the fuel station capital cost recovery in the price of fuel, these costs were not factored into the cost per mile comparisons.

Fueling and maintenance facilities. SunLine spent $1.47 million to design and construct its CNG fueling facility and adapt the maintenance facility. In partnership with Pickens Fuel Corporation, SunLine operates a public access 1200 scfm fuel station with two compressors. SunLine has a 25% ownership share and receives credits for all fuel sales; therefore, some of the capital costs are offset by the volume of sales to neighboring public and private fleets. Facility renovations included automated make-up air ventilation integrated into gas detection/alarm systems of 12 sensors for automatic activation of the new mechanical exhaust fans, explosion proof electrical conduit, sealed sulfur lighting, and totally enclosed heaters.

RT spent $3.5 million to design and construct its CNG fueling facility and adapt the maintenance facility. This included three compressors, dehydrators, buffer vessels, dispenser/control units, control room and emergency shutdown (ESD) system. RT's design, similar to SunLine's, incorporated 28 gas/fire sensors that detect the presence of gas and increased shop air flow through the installation of several new ventilation systems, both electric and passive.

It should be noted that many of these up-front costs of facility modification were incurred for safety reasons and a vast array of choices exist between regulatory jurisdictions

in interpreting guidance for the acceptable level of mitigation versus the potential for a hazardous occurrence.

Mechanic training. SunLine's mechanics attended 100 hours of training at College of the Desert (COD), which cost approximately $84,000 in mechanic wages and benefits. RT invested between $27,000 and $30,000 in labor costs to retrain their mechanics.

As is the case with any relatively new product, personnel need to be trained in order for the introduction of the new technology to be successful. SunLine and RT firmly believe the positive results shown in this study are directly related to thorough training practices. For training to be effectively implemented there has to be a commitment from top management toward the alternative fuel and acceptance of lost productivity during the transition period.

Costs of New Technology and the Payback. As discussed in the *Maintenance Cost Savings Analysis* section (page 6), both agencies replaced pressure relief devices which affected expenses. In 1998 following this study, RT began replacing their EDO brand cylinders because of a leakage problem, whereas cylinders usually last 15 years.

The up front costs incurred in fueling and maintenance facilities are not calculated here in terms of payback. Because both agencies have committed to procurement of a growing number of CNG vehicles over time, it would be inaccurate to load the upfront infrastructure costs against the initial vehicles. In SunLine's case, public access infrastructure supports paratransit and non revenue vehicles, as well as a variety of local government vehicles and heavy duty refuse trucks. At RT, their CNG bus fleet is growing each year and their 200+ fleet will be all CNG

in the next few years. Both agencies are in natural gas for the long run, and the greater the number of vehicles using the infrastructure, over time, the lower those costs are per vehicle and operating costs per mile.

Infrastructure is a substantial cost, but one that can be offset either by making the fueling facility a profit center (as SunLine has done) or by not incurring those costs at all by fueling off-site. Another way of looking at the cost is determining the cost of a diesel fueling facility and its ongoing facility costs.

POLICY IMPLICATIONS AND CONCLUSION

The savings resulting from CNG buses help maintain an equitable pace with inflation, thus enabling both agencies to plan for vehicle replacements and possibly add service, as the stability of future funding allows. Lower maintenance costs are attributable to thorough mechanic training. There also appears to be some longevity advantage for CNG life-cycle cost reduction because of reduced engine wear due to fewer engine deposits, resulting absence of engine knock, better oil life, and longer life of reciprocating engine components.

With the absence of carbon deposits leading to longer life of load bearing surfaces, the CNG engines at both agencies show no signs of needing a rebuild as is normally done with diesel engines at 250,000 miles. The Federal Transit Administration's standard 12-year replacement cycle could potentially be extended with maintenance practices concurrently improving chassis life expectancy (in favorable climactic environments). Particulate matter and other harmful emissions from CNG buses are greatly reduced over their diesel counterparts.

Prior studies indicate the operating costs of CNG buses are generally higher or about the same as diesel, but the number of CNG buses compared was much smaller than the number of diesel vehicles. The cost to operate five CNG buses at Pierce Transit was $0.28/mile and five CNG buses at Metro-Dade was $0.55/mile, as reported in the October 1996 National Renewable Energy Laboratory's (NREL) *Alternative Fuel Transit Buses, Final Results . . . from a Vehicle Evaluation Program*. The NREL study was closely matched with diesel controls. RT and SunLine's data are within the best and worst range of that report but showed much better results over diesel, which could be partly attributed to the age of RT's diesel engines.

RT will continue to procure buses with CNG engines to meet the goal of replacing the entire fleet by 2003. SunLine will continue to purchase only CNG or new clean technology replacement vehicles for service operation and support. Both agencies will pursue all subsequent improvements to CNG technology, with the goal of providing more reliable vehicles in a cleaner environment.

Use of CNG technology also improves the image of mass transit. Transit buses are usually thought of as belching black smoke, and no driver enjoys being behind a bus in slow moving traffic. CNG buses emit no black smoke particulates, which stain the buses making them appear unattractive, and they are also quieter to operate. This presents a more appealing perspective of bus riding; hopefully encouraging more individuals to use mass transit and take community pride in their transit systems.

In August of 1998, California became the first state in the nation to declare that diesel exhaust is a toxic air contaminant, one that can cause cancer and other disease.

With the growing environmental and health concerns of diesel, both agencies are sending strong messages to the citizens of their communities that alternative fuels help maintain a clean environment. Elected officials at both public agencies share a commitment to use alternative fuels and assist other local partners in using alternative fuels. Such efforts are already occurring with sanitation/refuse haulers, local water districts, car rental agencies, shuttle services, and municipalities. Both agencies are active participants in their regions' U.S. Department of Energy Clean Cities programs.

CNG buses support the local economies of Sacramento as the California state capitol, and the Coachella Valley as an international resort destination. Air quality is an important destination criteria to visitors and residents alike. Both Sacramento RT and SunLine have found a win-win in CNG with significant maintenance savings and emission reductions. It is more economical to power buses on CNG than diesel and both communities take pride in transit's leadership in promoting cleaner air.

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